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Weirdness of disgust sensitivity items predicts their relationship to purity moral judgments☆

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ABSTRACT

Disgust sensitivity predicts judgments of moral issues, especially when they concern transgressions of the purity domain. The reason for this domain-specific relationship is unclear. One potential explanation is that measures of disgust sensitivity and purity transgressions share an important characteristic: They are weird. We test this "weirdness overlap" hypothesis by examining whether weirdness of disgust sensitivity items relates to purity moral judgments (total $N = 805$). Weirder disgust sensitivity items were more strongly associated with moral judgments of purity, but not care, transgressions, suggesting support for the weirdness overlap hypothesis. However, the implications of this finding are limited as we find that eliminating the weirdest items from disgust sensitivity measures does not affect the tendency for the association between disgust sensitivity and moral judgments to be especially pronounced for purity transgressions. Although weirdness of disgust sensitivity items is associated with the disgust sensitivity-purity link, it cannot explain why disgust sensitivity is more strongly related to moral judgments of purity transgressions.

1. Introduction

Disgust sensitivity influences moral decision-making (e.g., Laakasuo, Sundvall, & Drosinou, 2017; Van Leeuwen, Dukes, Tybur, & Park, 2017). The relationship between disgust sensitivity and moral issues is especially pronounced for moral transgressions of the purity domain (Horberg, Oveis, Keltner, & Cohen, 2009; Wagemans, Brandt, & Zeelenberg, 2018). While this disgust-purity link is established, it is not yet clear what psychological mechanism can account for the domain-specific relationship. Some argue that the relative weirdness of transgressions representing the purity domain plays a role (Gray & Keeney, 2015), but previous research investigating this possibility has focused solely on the weirdness of moral transgressions (Wagemans, Brandt, & Zeelenberg, 2017). In the current paper, we flip the perspective and test a "weirdness overlap" hypothesis: Can weirdness of disgust sensitivity items predict their relationship to moral judgments of purity (i.e., weird) transgressions?

While disgust is thought to have evolved to protect us against diseases by distinguishing harmless from toxic foods, it has extended to moral contexts (Haidt, Rozin, McCauley, & Imada, 1997; Rozin, Lowery, Imada, & Haidt, 1999; Tybur, Lieberman, & Griskevicius, 2009). One recurring finding is that individual differences in disgust sensitivity predict opposition to moral and political issues, including homosexuality, abortion, and euthanasia (Crawford, Inbar, & Maloney, 2014; Inbar, Pizarro, & Bloom, 2009; Inbar, Pizarro, Knobe, & Bloom, 2009; Jarudi, 2009; Olatunji, 2008; Smith, Oxley, Hibbing, Alford, & Hibbing, 2011; Terrizzi, Shook, & Ventis, 2010). This relationship between disgust sensitivity and the moral domain is especially strong for acts violating a purity norm, with studies (Horberg et al., 2009), including pre-registered studies (Wagemans et al., 2018), showing a stronger relationship between disgust sensitivity and moral judgments of purity transgressions than moral judgments of transgressions of any other moral domain (i.e., care, authority, fairness, loyalty, and liberty).

1.1. Weirdness overlap hypothesis

What psychological mechanism can account for the disgust sensitivity-purity association? The "weirdness overlap" hypothesis is one potential explanation and involves the relative weirdness of purity transgressions. Gray and Keeney (2015) argued that a sampling bias of the moral domain resulted in purity transgressions (e.g., "Someone signs a piece of paper that says: I hereby sell my soul, after my death, to

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whoever has this piece of paper") that are substantially weirder than transgressions representing other moral domains (e.g., care: "Someone shoots and kills an animal that is a member of an endangered species"). While empirical studies do confirm that purity transgressions are perceived to be weirder than other types of transgressions, they either do not test (Gray & Keeney, 2015) or do not find (Wagemans et al., 2017) that transgression weirdness explains why disgust sensitivity is more strongly related to purity moral judgments.

However, perceived weirdness might not only be relevant for moral judgment items, but also for items measuring disgust sensitivity. Disgust is often experienced in response to atypical situations or stimuli, such as unknown or abnormal foods (e.g., insects, chocolate shaped as dog feces), close contact with strangers, and other unfamiliar situations (e.g., Curtis, Aunger, & Rabie, 2004; Rozin, Haidt, McCauley, Dunlop, & Ashmore, 1999; Rozin, Millman, & Nemeroff, 1986). Disgust in these situations may be the result of an overgeneralization of our behavioral immune system. The idea is that in survival terms, it is costlier to risk contact with infectious pathogens than it is to refrain from eating harmless foods or to avoid contact with potential cooperators (Haselton & Nettle, 2006; Park, Faulkner, & Schaller, 2003). When dealing with situations in which one is vulnerable for pathogen transmission characterized by atypicality, the behavioral immune system thus biases towards risk avoidance (resulting in a disgust response) as we do not know whether these weird stimuli carry diseases.

Because many real-life disgust situations are atypical, measures of disgust sensitivity also include hypothetical situations that are weird; however, the level of weirdness varies. The frequently used Disgust Sensitivity Scale (Haidt, McCauley, & Rozin, 1994) includes scenarios we find relatively normal (e.g., "I never let any part of my body touch the toilet seat in public restrooms"), but also scenarios we find substantially weirder ("I might be willing to try eating monkey meat, under some circumstances"). Disgust reactions to these weird disgust situations may be a good predictor of moral judgments of other weird situations, such as those of the purity domain. Hence, weird disgust sensitivity items should be more strongly related to moral judgments of purity transgressions. Put differently, we expect that the relationship between a disgust sensitivity item and moral judgments of purity transgressions depends, partly, on how weird that disgust sensitivity item is.

1.2. Weird or infrequent?

Notably, many situations that elicit disgust are weird in the sense that they occur infrequently because people are generally motivated to withdraw from and avoid future contact with potentially contaminating objects or situations (e.g., Mortensen, Becker, Ackerman, Neuberg, & Kenrick, 2010; Olatunji, Haidt, McKay, & David, 2008). In line with this reasoning, one could argue that all disgust sensitivity items characterized by infrequency are more strongly related to purity moral judgments. However, this assumes that weirdness and (in)frequency are the same construct. This is not necessarily the case. Abnormalities can be the result of deviating from either a statistical norm (i.e., frequency) or a prescriptive norm (i.e., weirdness; Hitchcock & Knobe, 2009). While frequency refers to how often a behavior occurs, weirdness is the extent to which a certain behavior breaks conventional rules or departs from moral or social norms (Chakroff & Young, 2015; Hitchcock & Knobe, 2009) and so refers to the degree to which a behavior is seen as unusual and unexpected within a given context. (In)Frequency and weirdness overlap to some degree as behaviors that are considered weird typically occur infrequently. However, the opposite is not always true. One example from a measure of disgust sensitivity is the item, "Sharing an elevator with a man with a disfigured face" (London Disgust Scale; Curtis, 2013). Although this situation might not occur frequently in daily life, our data (below) show that it is not considered to be weird either. We expect weirdness to be predictive of a disgust sensitivity item's relationship to purity moral judgments because it is weirdness (and not frequency) that distinguishes purity moral judgments from other types of moral judgments (Chakroff & Young, 2015; Gray & Keeney, 2015; Wagemans et al., 2017).

1.3. Current study

We test two predictions following from the weirdness overlap hypothesis. The first prediction is that weirdness, but not (in)frequency, of disgust sensitivity items relates positively to the strength of their relationship with moral judgments of purity transgressions. This relationship is expected to be specific to transgressions of the purity domain (i.e., weird transgressions). Care moral judgments are used as a comparison domain that is not characterized by weirdness. The second prediction is that the stronger relationship between disgust sensitivity and moral judgments of purity versus care transgressions found in prior work (e.g., Wagemans et al., 2018) depends on the usage of highly weird disgust sensitivity items. We test if the relationship between disgust sensitivity and moral judgments of purity transgressions disappears when excluding weird disgust sensitivity items from the disgust sensitivity scale.

2. Method

We collected data on the relationship between disgust sensitivity items and moral judgments of purity and care transgressions in Sample 1 and combine these with data from an independent second sample (i.e., Sample 2) that rated disgust sensitivity items on their weirdness and frequency.[1]

2.1. Sample 1

2.1.1. Participants

600 MTurkers completed our study in return for a financial reward ($0.70 for 5–7 min; 316 males, 282 females, 2 other, M_{age} = 35.37, SD = 11.25).[2]

2.1.2. Materials

Participants judged ten purity (α = .89) and ten care (α = .91) moral transgressions from a standardized set of vignettes based on Moral Foundations Theory (Clifford, Iyengar, Cabeza, & Sinnott-Armstrong, 2015). Example items are, respectively, "You see a story about a remote tribe eating the flesh of their deceased members" and "You see a woman clearly avoiding sitting next to an obese woman on the bus". Participants indicated how immoral they found each behavior on a scale ranging from 1 = 'Not at all immoral' to 7 = 'Extremely immoral'.

Next, participants were randomly assigned to fill out one of three disgust sensitivity measures: The 32-item Disgust Sensitivity Scale (DSS; Haidt et al., 1994; N = 201, α = .92), the 30-item London Disgust Scale (LDS; Curtis, 2013; N = 199, α = .94), and the 21-item Three Domain Disgust Scale (TDDS; Tybur et al., 2009; N = 200, α = .91). Example items for the DSS and LDS are, respectively, "You see maggots on a piece of meat in an outdoor garbage pail," and "Watching a woman pick her nose." The TDDS has three very distinct subscales; pathogen, sexual, and moral disgust. Example items are, respectively, "Standing close to a person who has body odor," "Finding out that someone you don't like has sexual fantasies about you," and "Deceiving a friend." Items of all scales were measured on a 7-point scale. Anchor labels for the first 17

[1] Replication materials, data, and syntax are in the Supplemental Materials at the Open Science Framework.

[2] Another 199 participants completed the Disgust Propensity and Sensitivity Scale (Van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006). We excluded this scale in this study, because it focuses on introspection (e.g., "I find something disgusting") instead of hypothetical scenarios.

items of the DSS were 1 = 'Strongly disagree (very untrue about me)' and 7 = 'Strongly agree (very true about me)'. For the remaining 15 items of the DSS and all items of the TDDS and LDS these were 1 = 'Not at all disgusting' and 7 'Extremely disgusting'.

2.2. Sample 2

2.2.1. Participants

205 MTurkers completed the study in return for a financial reward ($0.70 for 5–7 min; 139 males, 65 females, 1 other, M_{age} = 33.78, SD = 9.77).

2.2.2. Materials

The 83 items of the abovementioned disgust sensitivity scales were divided into two sets (of 41 and 42 items) and each participant was randomly assigned to provide weirdness and frequency ratings of one of these sets (with item order randomized). Weirdness and frequency were assessed with "Please indicate how weird (i.e., unusual, bizarre, odd) you find these situations" and "Please indicate how frequently (i.e., typical or common) these situations occur in everyday life." Answers were given on a 7-point scale ranging from 1 = "Not at all weird [frequent]" to 7 = "Extremely weird [frequent]." Reliabilities of these ratings were for weirdness ICC_{set1} = .34 and ICC_{set2} = .42, both p's < .001, and for frequency ICC_{set1} = .35 and ICC_{set1} = .32, both p's < .001.

3. Results

The analyses proceed in three steps. First, in Sample 1, we replicate the finding we aim to explain, that disgust sensitivity is more strongly related to moral judgments of purity than care transgressions (Wagemans et al., 2018). Second, we combine the data from Sample 1 and 2 to investigate whether disgust sensitivity items' weirdness and frequency ratings predict their relationship to moral judgments of purity and care transgressions. Third, we re-analyze the Sample 1 data by testing disgust sensitivity's relationship to moral judgments of purity and care transgressions separately for highly weird and more normal disgust sensitivity items.

3.1. Disgust sensitivity and moral domain interaction

Linear mixed-effects models were used to test whether the data of Sample 1 replicate the finding that disgust sensitivity is more strongly related to moral judgments of purity than care transgressions, using the "lmer" function in the "lme4" and "lmerTest" packages of R (Bates, Mächler, Bolker, & Walker, 2015; Kuznetsova, Brockhoff, & Christensen, 2013). Confidence intervals were obtained using the "confint" function in the "stats" package using Monte Carlo simulations with 1000 bootstrap samples (R Core Team, 2017). All models take random variance of participants and moral judgment items into account. For the TDDS, analyses were conducted for each subscale separately, as is often the case with this scale (e.g., Park, Van Leeuwen, & Stephen, 2012; Tybur, Merriman, Caldwell Hooper, McDonald, & Navarrete, 2010). There is substantial overlap between its moral disgust subscale and transgressions of the care domain, which makes it more likely that this subscale shows the reversed pattern: A stronger relationship to moral judgments of care, as compared to purity, transgressions.

A model including disgust sensitivity (mean-centered), moral domain (1 = purity, 0 = care), and their interaction revealed an interaction effect of disgust sensitivity and moral domain on moral judgments for each of the disgust sensitivity (sub)scales. The coefficients for the interaction effects and their confidence intervals are presented in Fig. 1. As expected, the DSS, the LDS, and the pathogen and sexual disgust subscales of the TDDS replicate the finding that disgust sensitivity is more strongly related to moral judgments of purity (DSS: b = 0.74, SE = 0.08, p < .001; LDS: b = 0.47, SE = 0.08, p < .001; TDDS-Pathogen: b = 0.43 SE = 0.07, p < .001, TDDS-Sexual: b = 0.36, SE = 0.05, p < .001) than care transgressions (DSS: b = 0.50, SE = 0.08, p < 001; LDS: b = 0.20, SE = 0.08, p = .02; TDDS-Pathogen: b = 0.22, SE = 0.07, p = .002, TDDS-Sexual: b = 0.22, SE = 0.05, p < .001). Although marginally significant (p = .0504), the moral disgust subscale of the TDDS followed the expected reversed pattern, with a stronger relationship between moral disgust sensitivity and moral judgments of care (b = 0.32, SE = 0.04, p < .001), as compared to purity (b = 0.21, SE = 0.05, p < .001).

3.2. Weirdness and frequency of disgust sensitivity items

Next, we tested the weirdness overlap hypothesis that disgust sensitivity's relationship with moral judgments of the purity domain can be predicted by the weirdness of a disgust sensitivity item. We used the data of Sample 1 to calculate the correlations of each disgust sensitivity item with moral judgments of purity and care transgressions. These correlation coefficients were then matched with each disgust sensitivity item's average weirdness and frequency scores from Sample 2. The 'cor.test' function in the 'stats' package of R (R Core Team, 2017) was used to calculate the correlations between weirdness and frequency of a disgust sensitivity item (estimated in Sample 2) and the correlation of that item with moral judgments of purity and care transgressions (estimated in Sample 1). This resulted in a database with 85 observations on four variables.

Consistent with the weirdness overlap hypothesis, there was a significant correlation between the weirdness of disgust sensitivity items and the strength of their relationship to purity moral judgments (r[83] = .36, p < .001, Fig. 2, Top-Left Panel). The weirder a disgust sensitivity item is, the stronger that item's relationship is to moral judgments of purity transgressions. As expected, this relationship is specific to the purity domain, as no relationship was found between weirdness of disgust sensitivity items and the strength of their relationship to moral judgments of care transgressions (r[83] = −.02, p = .87, Fig. 2, Bottom-Left Panel). Conducting the same analyses for frequency of occurrence did not yield any substantive results. A disgust sensitivity item's frequency was not correlated with the strength of its relationship to moral judgments of purity (r[83] = −.11, p = .32, Fig. 2, Top-Right Panel), nor care (r[83] = −.03, p = .81, Fig. 2, Bottom-Right Panel) transgressions.

3.3. Reanalysis of disgust sensitivity and moral domain interaction

Are there consequences for including weird items in disgust sensitivity measures? We investigated this by testing whether the interaction between disgust sensitivity and moral domain depends on the inclusion of weird disgust sensitivity items. We re-analyzed the data from Sample 1 separately for disgust sensitivity items scoring below and above the median weirdness rating (i.e., 3.38) and compared the findings.

A model including disgust sensitivity (measured with items scoring high or low on weirdness; mean-centered), moral domain (1 = purity, 0 = care), and their interaction was fit to the dataset of each (sub)scale. An interesting pattern emerged (see Fig. 1). For the DSS, the LDS, and the pathogen subscale of the TDDS, the interaction between disgust sensitivity and moral domain tended to be slightly stronger when disgust sensitivity was measured with disgust sensitivity items scoring high, as compared to low, on weirdness. However, these differences were quite small and well within the confidence intervals of the other estimates.

We conducted z-tests to test whether these interaction effects differed in magnitude for disgust sensitivity items scoring high and low on weirdness. For all but one sub(scale) no significant differences were found (all z's < 0.88, all p's > .38). A significant difference was found for the sexual disgust subscale of the TDDS (z = 2.15, p = .03), but this was in the *opposite* direction of what was expected by the weirdness

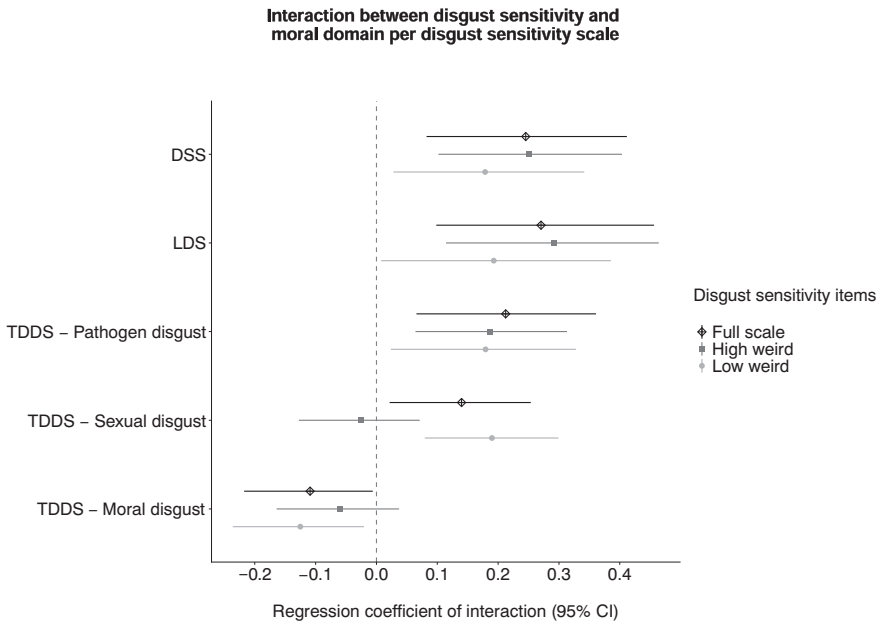

Fig. 1. Unstandardized regression coefficients of the interaction between disgust sensitivity and moral domain (purity = 1, care = 0) on moral judgments for each disgust sensitivity scale, including the full scale, high weirdness items, and low weirdness items. Positive coefficients indicate a stronger relationship to moral judgments of purity than care transgressions.

overlap hypothesis. Rather than becoming stronger and more positive, the interaction effect became non-significantly negative for weirder items. That is, although at an item level the weirdness of disgust sensitivity items may affect the size of the disgust sensitivity-purity judgment association (consistent with the weirdness overlap hypothesis), when used as a combined scale the effects of disgust sensitivity weirdness do not affect conclusions about the link between disgust sensitivity and moral judgments (inconsistent with the weirdness overlap hypothesis).

4. Discussion

Purity moral transgressions are substantially weirder than other types of moral transgressions, suggesting that weirdness might account for the disgust-purity link (Gray & Keeney, 2015). We tested a "weirdness overlap" hypothesis, which predicts that the weirdness of disgust sensitivity items predicts the strength of their relationship to moral judgments of purity (i.e., weird) transgressions. The results of our study support that prediction and show that the relationship is specific to the moral domain of purity (i.e., weird transgressions). Importantly, however, we find no evidence that the inclusion of weird disgust sensitivity items explains the interaction between disgust sensitivity and domain on moral judgments.

As expected, many of the disgust sensitivity items occurred relatively infrequently ($M_{\text{frequency}} = 2.37$, $SD = 0.86$, median = 2.21), but were not necessarily perceived to be weird ($M_{\text{weirdness}} = 3.67$, $SD = 1.13$, median = 3.38). Even though the two constructs were highly correlated ($r[83] = -.80$, $p < .001$), they showed two distinct patterns of results. While disgust sensitivity items' weirdness ratings had a moderately strong correlation with the strength of items' relationship to moral judgments of purity transgressions, there was no such relationship for disgust sensitivity items' frequency of occurrence. This suggests that there is conceptual utility in distinguishing between weirdness and (in)frequency, and that additional work should investigate the conceptual and causal relationships between disgust and weirdness.

We tested the "weirdness overlap" hypothesis on the level of items. One limitation of this approach is that we treat an item's weirdness and frequency score as a constant factor, which might not be the case. The relatively low ICC's (i.e., between .32 and .42) suggest that individuals do not fully agree which items are weird/occur frequently and this measurement error negatively affects the precision of our results and also reduces the statistical power of our study. It is possible that there are individual differences in perceptions of weirdness and frequency, which future research could test by using a fully within-subjects design. For example, it could be that some individuals are more sensitive to weird situations in general, and because of that sensitivity react more negatively to both weird disgust sensitivity items (i.e., with more disgust) and weird moral judgment items (i.e., with more moral condemnation). However, while this logic explains why disgust sensitivity relates to moral judgments in general, it cannot explain why disgust sensitivity has a stronger relationship to moral judgments of purity specifically. In other words, it is not exactly clear why such weirdness sensitive individuals would react differently to variation in weirdness of purity and other types of transgressions.

Additionally, we want to note the potential importance of cultural norms on perceptions of weirdness and frequency. What may be weird or occur infrequently in one culture, might be relatively normal or even norm-abiding in another culture (e.g., the item "You are served a dish made of cow's tongue and cheek"). In our study, we used the Amazon Mechanical Turk (i.e., MTurk) platform to recruit an American sample because previous research on the relationship between disgust sensitivity and moral judgments and on the weirdness of purity transgressions has also mostly used American subjects. However, it should be noted that MTurk workers are not an exact representation of the general American population as the sample is self-selected (see Paolacci & Chandler, 2014). This self-selection bias results, for example, in MTurk samples that are relatively young, educated, and liberal (Berinsky, Huber, & Lenz, 2012; Huff & Tingley, 2015). These, and other, differences between MTurk workers and the general American population could affect our findings[3] and it thus remains to be tested whether our findings hold in other samples, including more representative American samples.

5. Conclusion

We reasoned that the often found link between disgust sensitivity

[3] In our study, age and education level did not predict weirdness or frequency ratings. Political ideology was associated with weirdness, but not frequency ratings. However, using conservatives' or liberals' mean weirdness ratings does not affect our conclusions. See Supplemental Materials for more information.

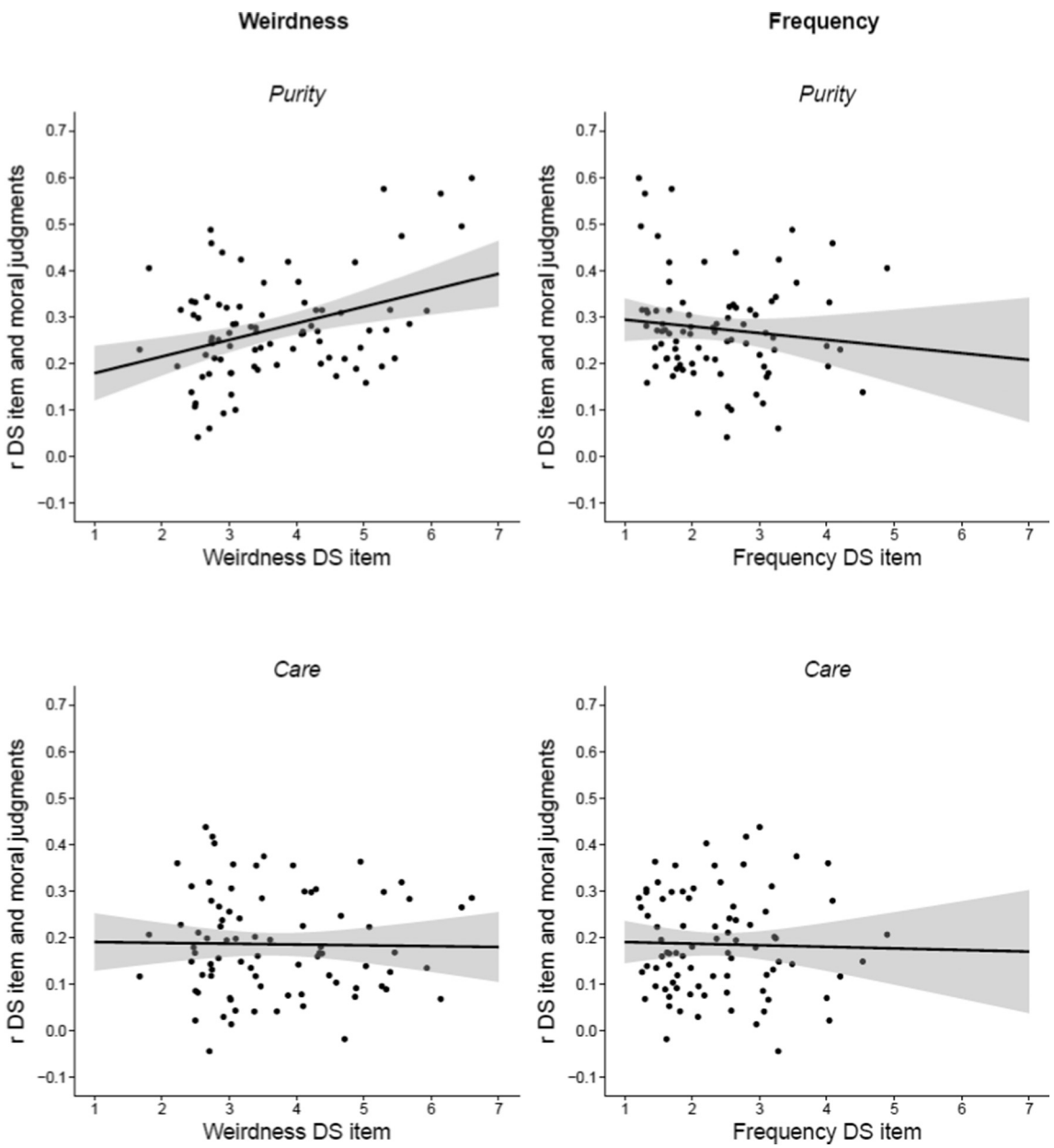

Fig. 2. The relationship between weirdness and frequency of occurrence of disgust sensitivity items (x-axis) and their correlation with moral judgments per moral domain (purity versus care, y-axis).

and purity issues might be explained by a shared characteristic of items measuring these constructs: Weirdness. We only find partial evidence for this weirdness overlap hypothesis and have to conclude that the stronger relationship between disgust sensitivity and moral judgments of the purity domain is unlikely to be due to weirdness overlap. In contrast to earlier suggestions that weirdness is a confound (Gray & Keeney, 2015), it seems that weirdness is a meaningful factor in each of these constructs. Future work will be necessary to determine if weirdness is one of the features distinguishing purity from other types of moral transgressions (also see Graham, 2015; Sabo & Giner-Sorolla, 2017) and if weirdness might induce disgust when combined with a possibility for pathogen transmission (i.e., when weirdness equals an uncertain and risky situation).

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